ECE 345 / ME 380: Introduction to Control Systems
Collaborative Quiz #3 Grading Sheet

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This quiz is open-note and open-book. Computational tools (Matlab, calculators) are allowed. No partial credit will be awarded. For each of the questions, clearly write the correct answer.

In-Class Questions

1. C
2. E
3. A and C
4. $0 < K < 84$
5. The response to a step input is stable for $K < 84$, as we see in the plots of Figure 4. Once K goes above 84, the system begins to grow exponential and is no longer BIBO stable, as is evidenced in our MATLAB plot for $K = 100$. The amplitude of the oscillations grow until the system breaks.

$a_2 = 7 \quad a_1 = 12 \quad a_0 = K$

1) $a_1 a_2 - a_0 > 0 \rightarrow 84 - K > 0$ $\boxed{84 > K}$

2) $a_2 > 0$, $a_1 > 0$, $a_0 > 0$ $\boxed{K > 0}$

s^3	1 (a_3)	12 (a_1)
s^2	7 (a_2)	K (a_0)
s^1	$\frac{84-K}{7}$ (b_1)	0
s^0	K (c_1)	0

Statement of Effort

By signing below, I pledge that I have written this quiz as per the indicated instructions, and fully participated in the group.

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1.1 Location of poles and zeros of G(s)

```
num1=[1]; den1=[1 7 12 0];roots(den1)
```

```
ans = 3×1
     0
    -4
    -3
```

1.3 Step response of the open-loop system

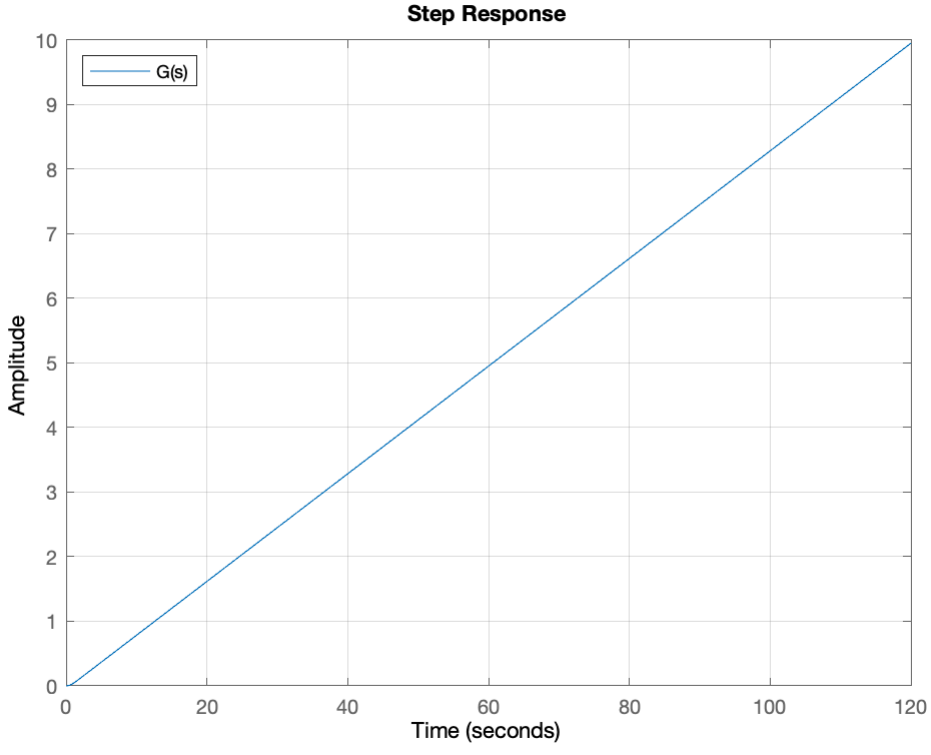
```
sys1=tf(num1,den1)
```

```
sys1 =

          1
  ------------------
  s^3 + 7 s^2 + 12 s

Continuous-time transfer function.
```

```
step(sys1);grid;legend('G(s)','location','northwest')
```



2.5 Step response of the closed-loop system with K=100 over 0 to 20

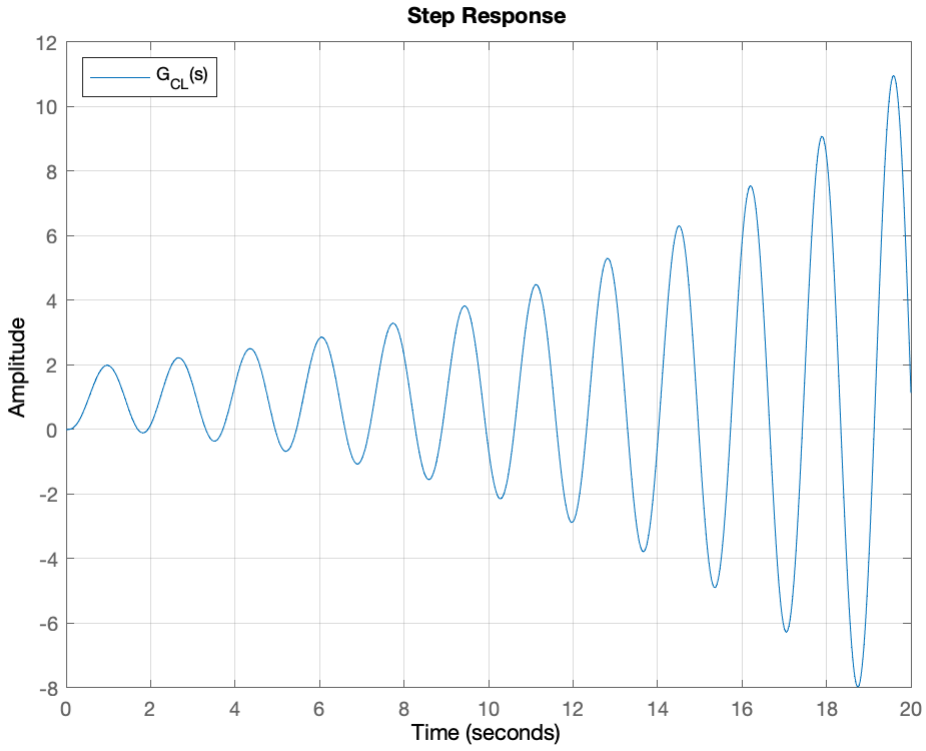
```
K=100;tfinal=20;
sys2=K*feedback(sys1,K)
```

```
sys2 =

           100
  ------------------------
  s^3 + 7 s^2 + 12 s + 100

Continuous-time transfer function.
```

```
t=0:0.01:tfinal;
step(sys2,t);grid;legend('G_{CL}(s)','location','northwest');legend('G_{CL}(s)')
```




```
% legend called twice to fix subscript bug
```